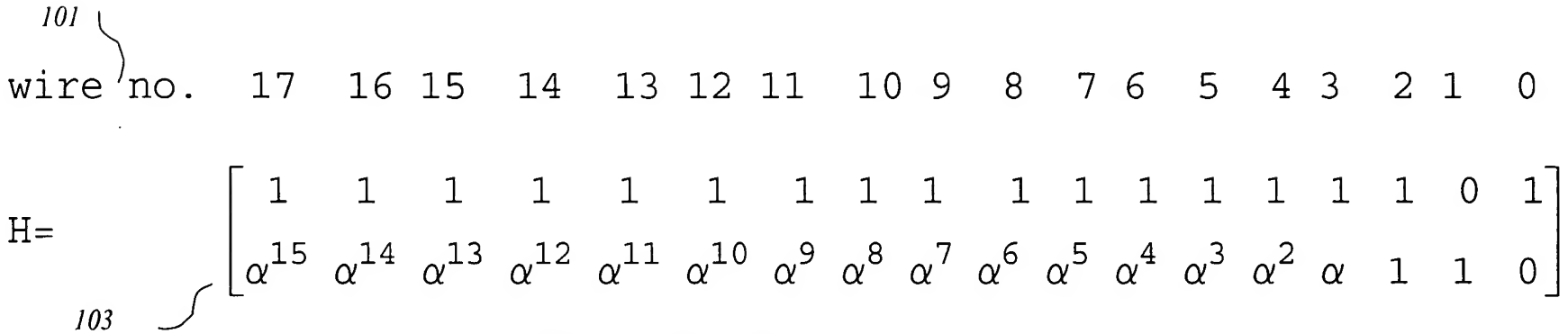


***FIG. 1** (PRIOR ART)*

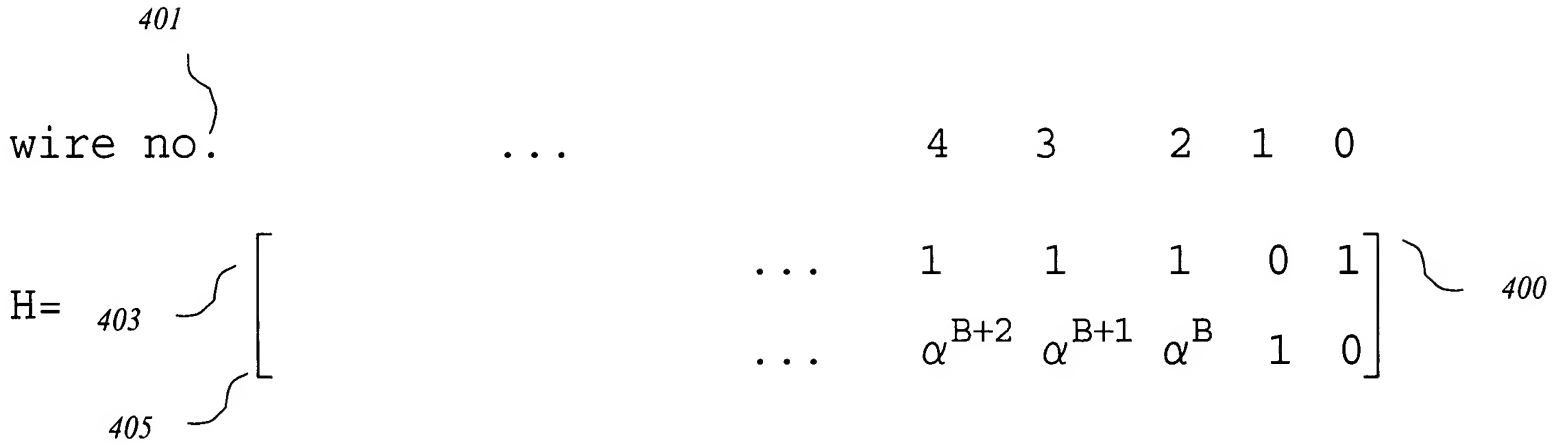


***FIG. 4***

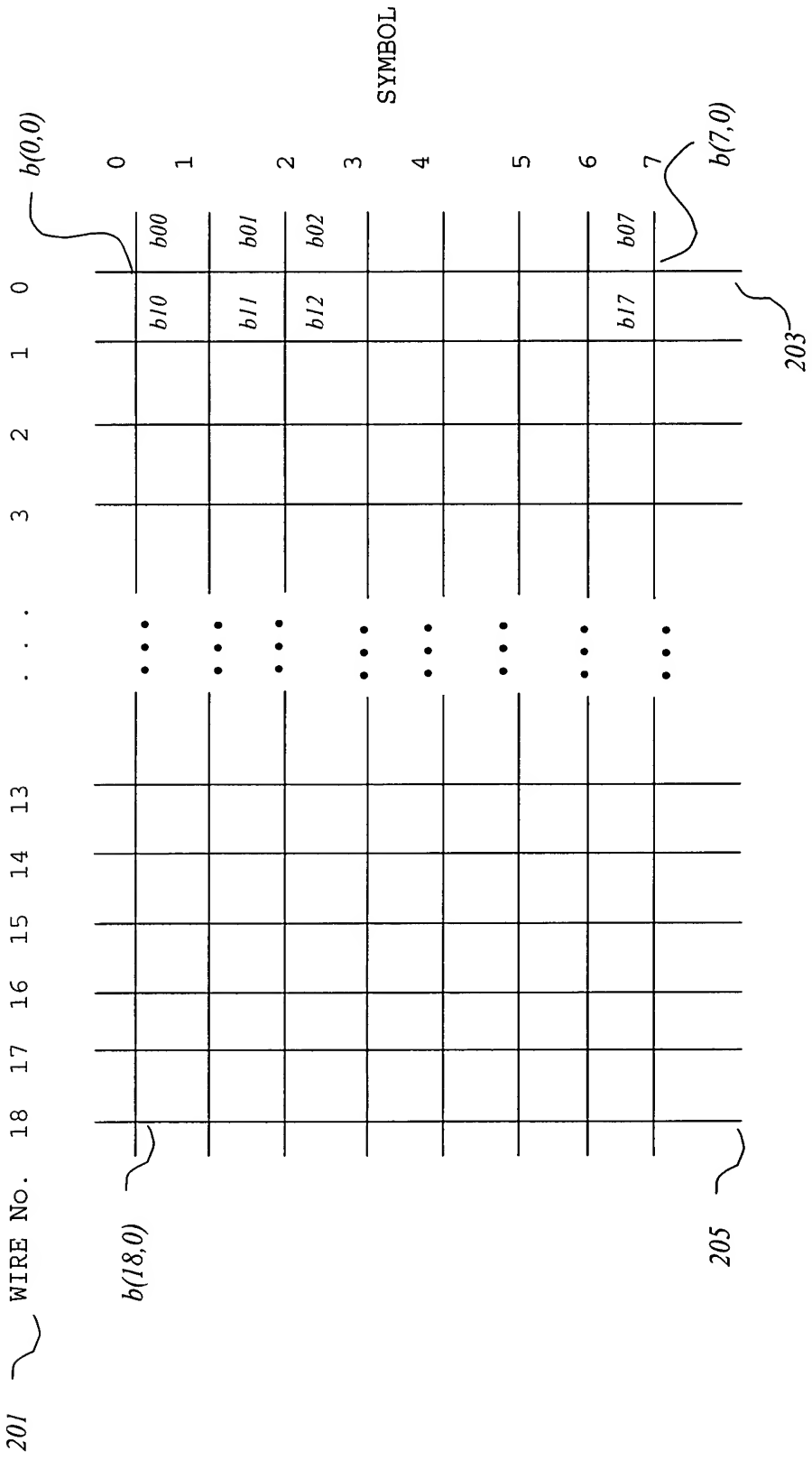


*FIG. 2*
*(PRIOR ART)*

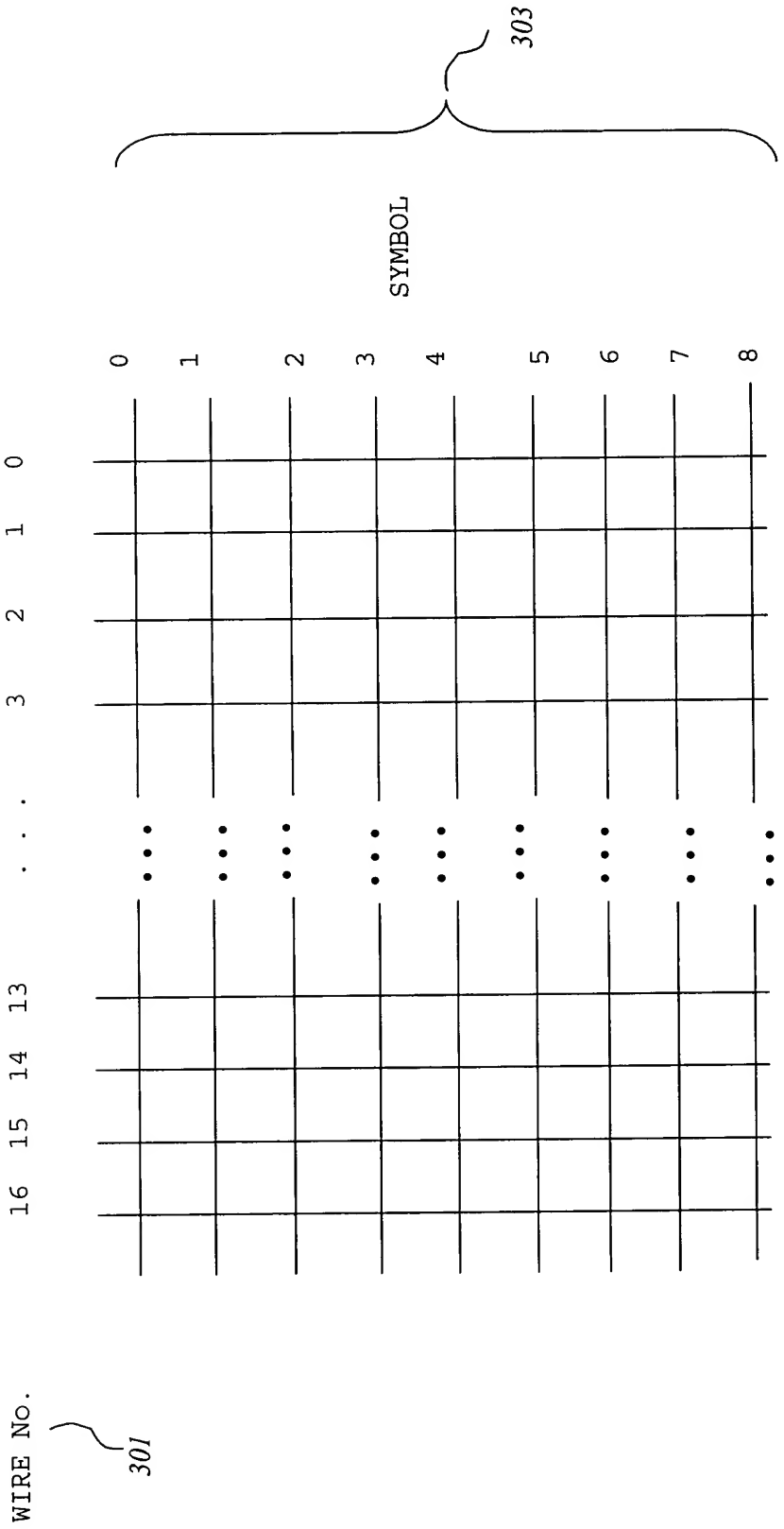


*FIG. 3*

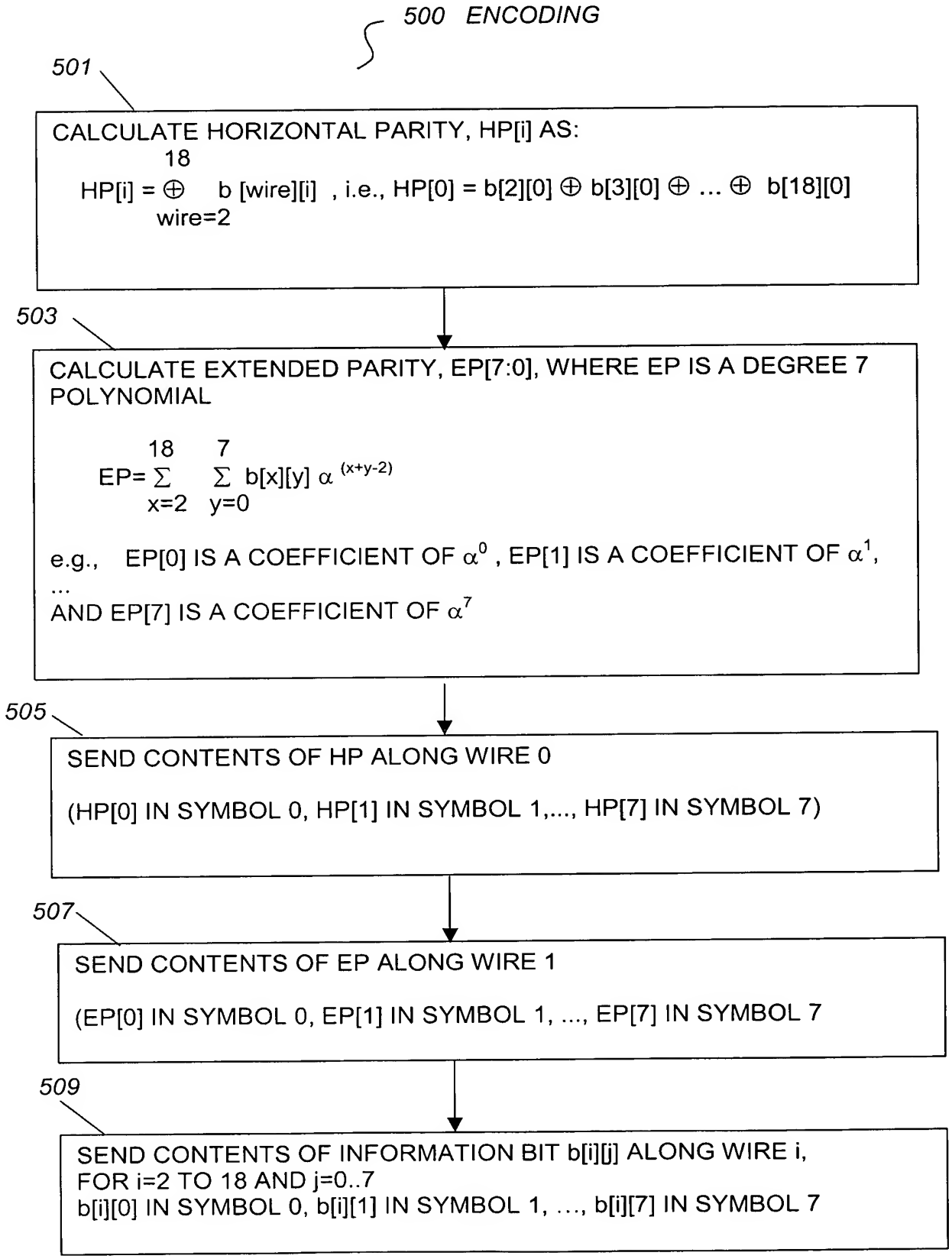


***FIG. 5***
*(PRIOR ART)*

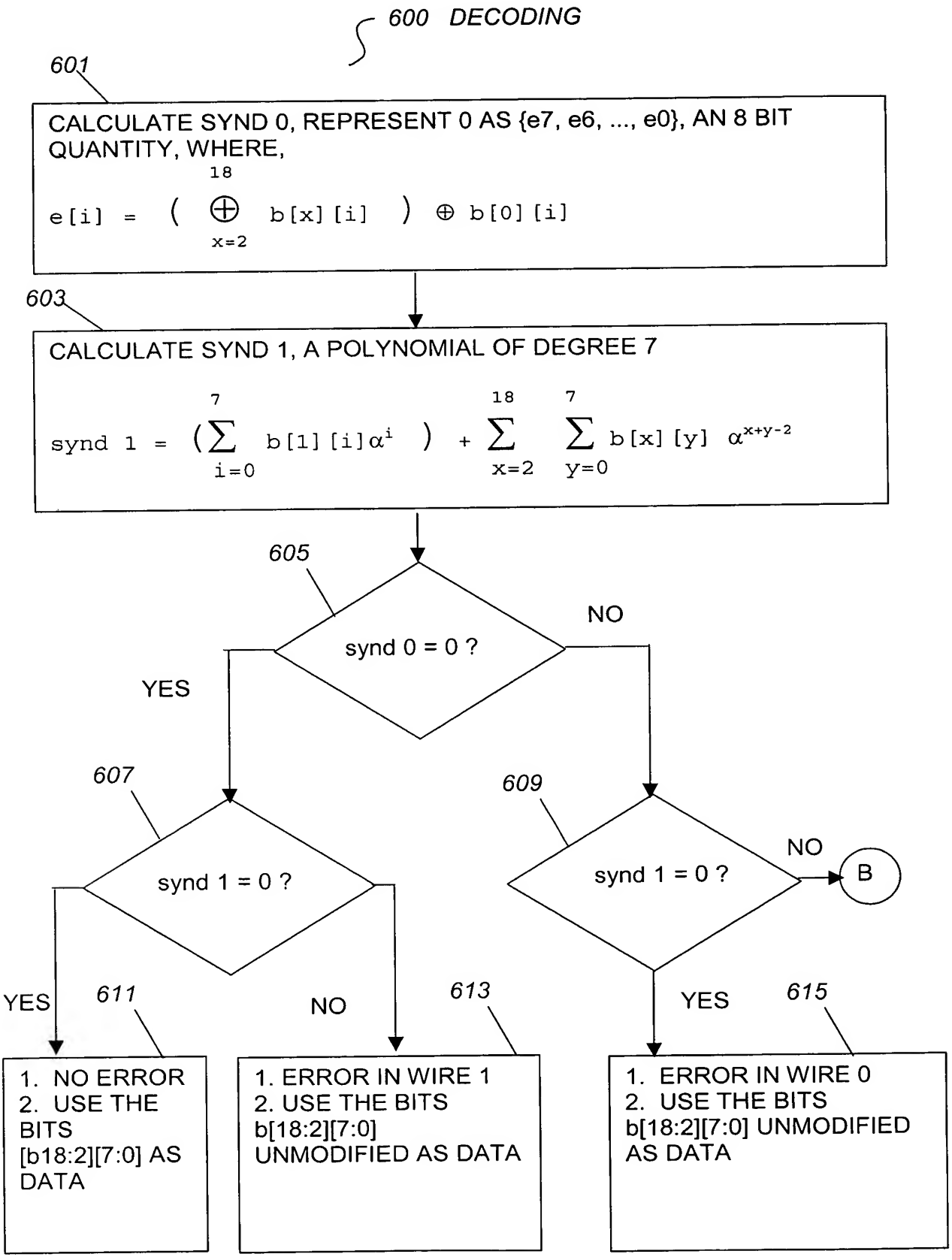


***FIG. 6A*** *(PRIOR ART)*

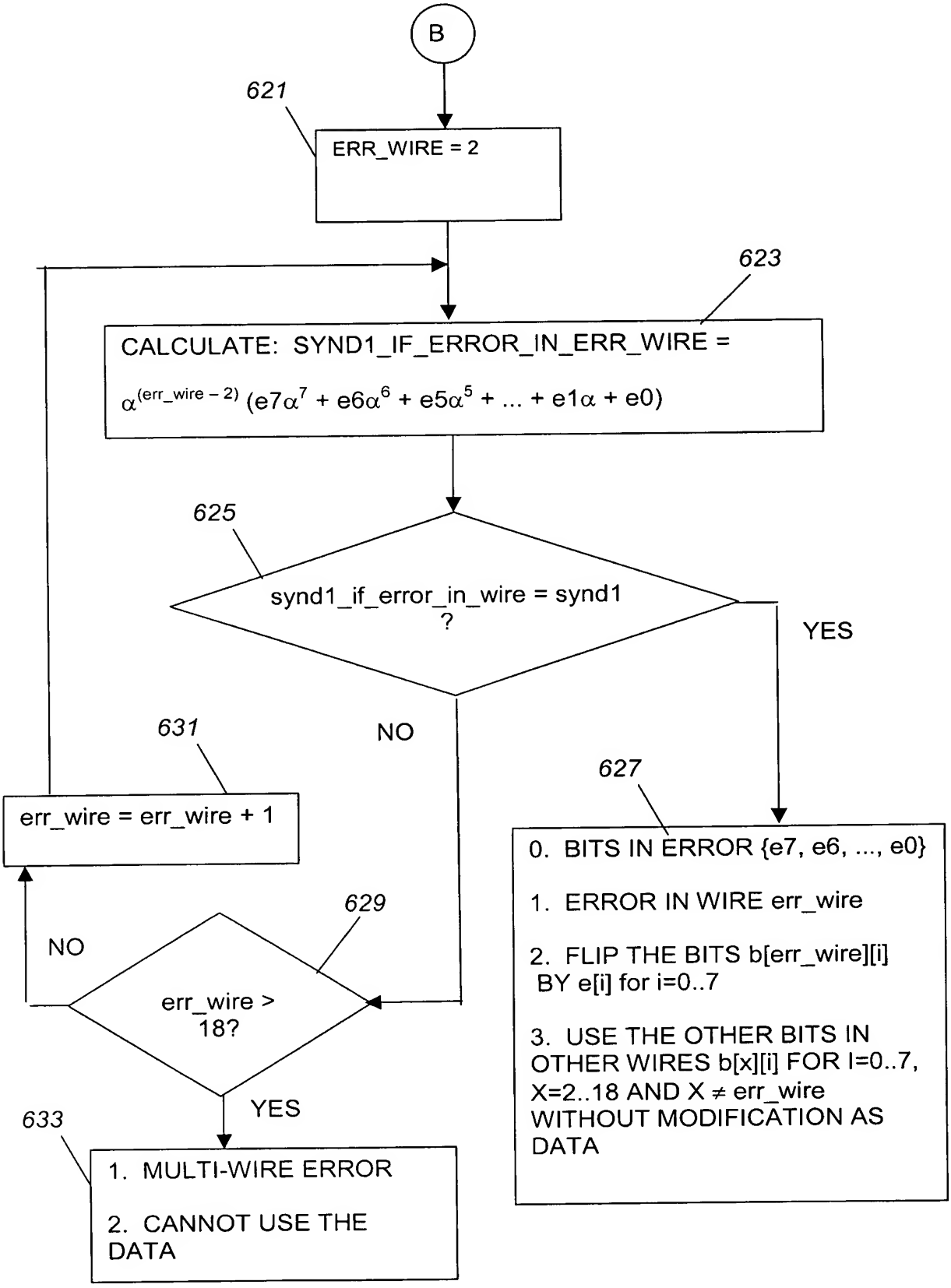


***FIG. 6B** (PRIOR ART)*

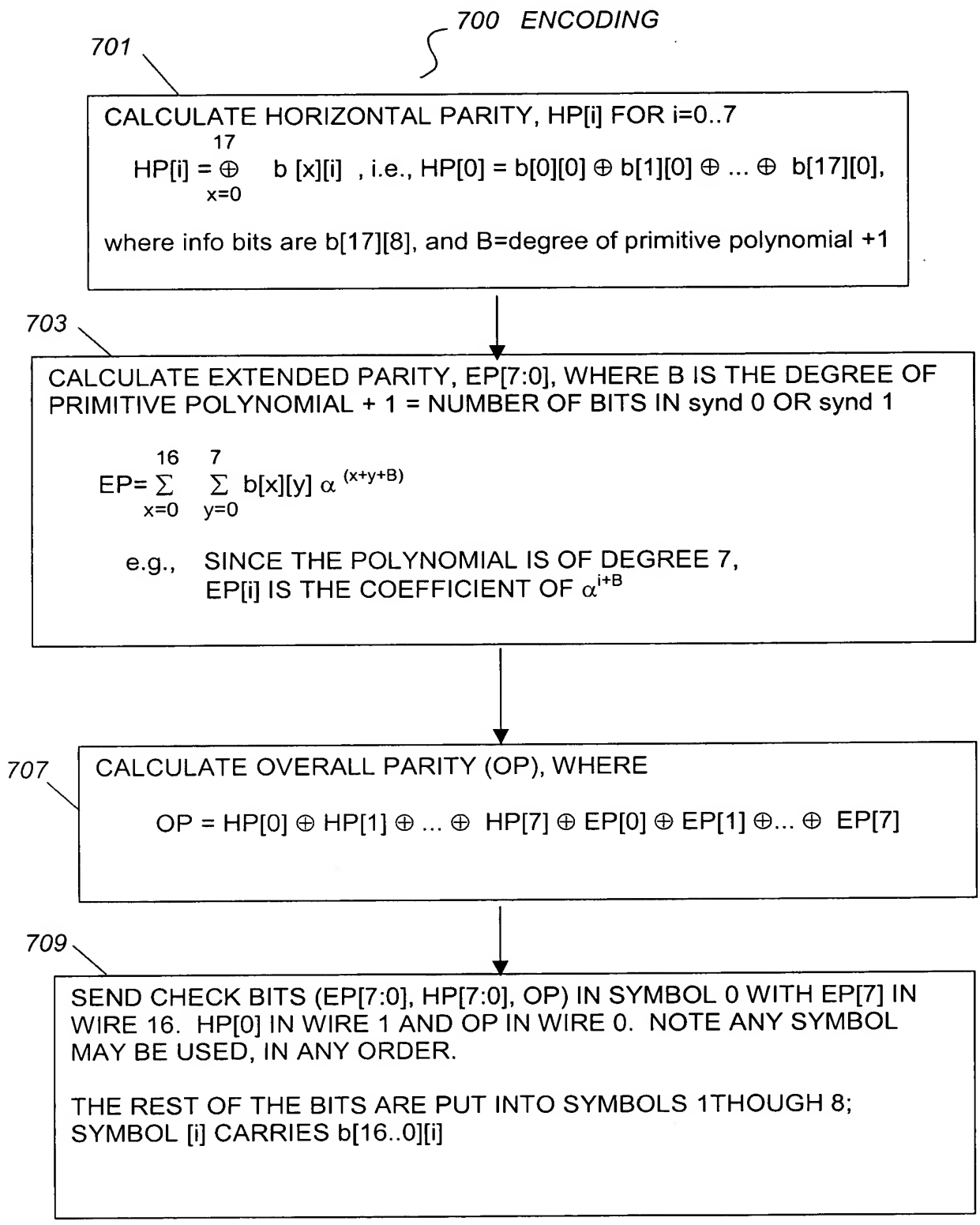
700 ENCODING
701
CALCULATE HORIZONTAL PARITY, HP[i] FOR i=0..7
HP[i] = ⊕ (x=0 to 17) b [x][i] , i.e., HP[0] = b[0][0] ⊕ b[1][0] ⊕ ... ⊕ b[17][0],
where info bits are b[17][8], and B=degree of primitive polynomial +1
703
CALCULATE EXTENDED PARITY, EP[7:0], WHERE B IS THE DEGREE OF PRIMITIVE POLYNOMIAL + 1 = NUMBER OF BITS IN synd 0 OR synd 1
EP= Σ (x=0 to 16) Σ (y=0 to 7) b[x][y] α (x+y+B)
e.g., SINCE THE POLYNOMIAL IS OF DEGREE 7, EP[i] IS THE COEFFICIENT OF α i+B
707
CALCULATE OVERALL PARITY (OP), WHERE
OP = HP[0] ⊕ HP[1] ⊕ ... ⊕ HP[7] ⊕ EP[0] ⊕ EP[1] ⊕... ⊕ EP[7]
709
SEND CHECK BITS (EP[7:0], HP[7:0], OP) IN SYMBOL 0 WITH EP[7] IN WIRE 16. HP[0] IN WIRE 1 AND OP IN WIRE 0. NOTE ANY SYMBOL MAY BE USED, IN ANY ORDER.
THE REST OF THE BITS ARE PUT INTO SYMBOLS 1THOUGH 8; SYMBOL [i] CARRIES b[16..0][i]

***FIG. 7***

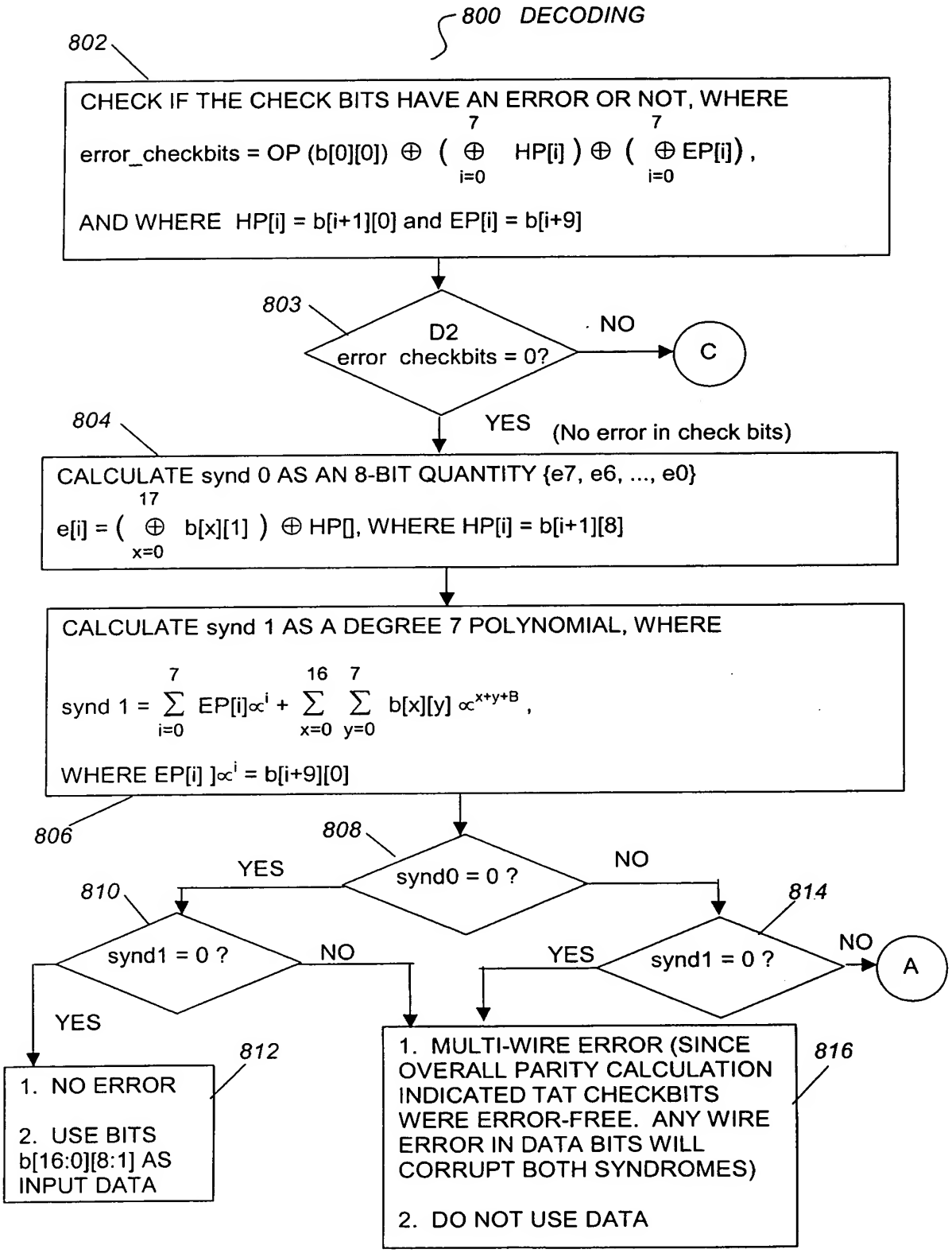
800 DECODING
802
CHECK IF THE CHECK BITS HAVE AN ERROR OR NOT, WHERE
error_checkbits = OP (b[0][0]) ⊕ ( ⊕ HP[i] ) ⊕ ( ⊕ EP[i]),
AND WHERE HP[i] = b[i+1][0] and EP[i] = b[i+9]
803
D2
error checkbits = 0?
NO
C
YES
(No error in check bits)
804
CALCULATE synd 0 AS AN 8-BIT QUANTITY {e7, e6, ..., e0}
e[i] = ( ⊕ b[x][1] ) ⊕ HP[], WHERE HP[i] = b[i+1][8]
CALCULATE synd 1 AS A DEGREE 7 POLYNOMIAL, WHERE
synd 1 = Σ EP[i]∝^i + Σ Σ b[x][y] ∝^(x+y+B),
WHERE EP[i] ]∝^i = b[i+9][0]
806
808
synd0 = 0 ?
YES
NO
810
synd1 = 0 ?
NO
YES
814
synd1 = 0 ?
NO
A
YES
812
1. NO ERROR
2. USE BITS b[16:0][8:1] AS INPUT DATA
1. MULTI-WIRE ERROR (SINCE OVERALL PARITY CALCULATION INDICATED TAT CHECKBITS WERE ERROR-FREE. ANY WIRE ERROR IN DATA BITS WILL CORRUPT BOTH SYNDROMES)
2. DO NOT USE DATA
816

*FIG. 8A*

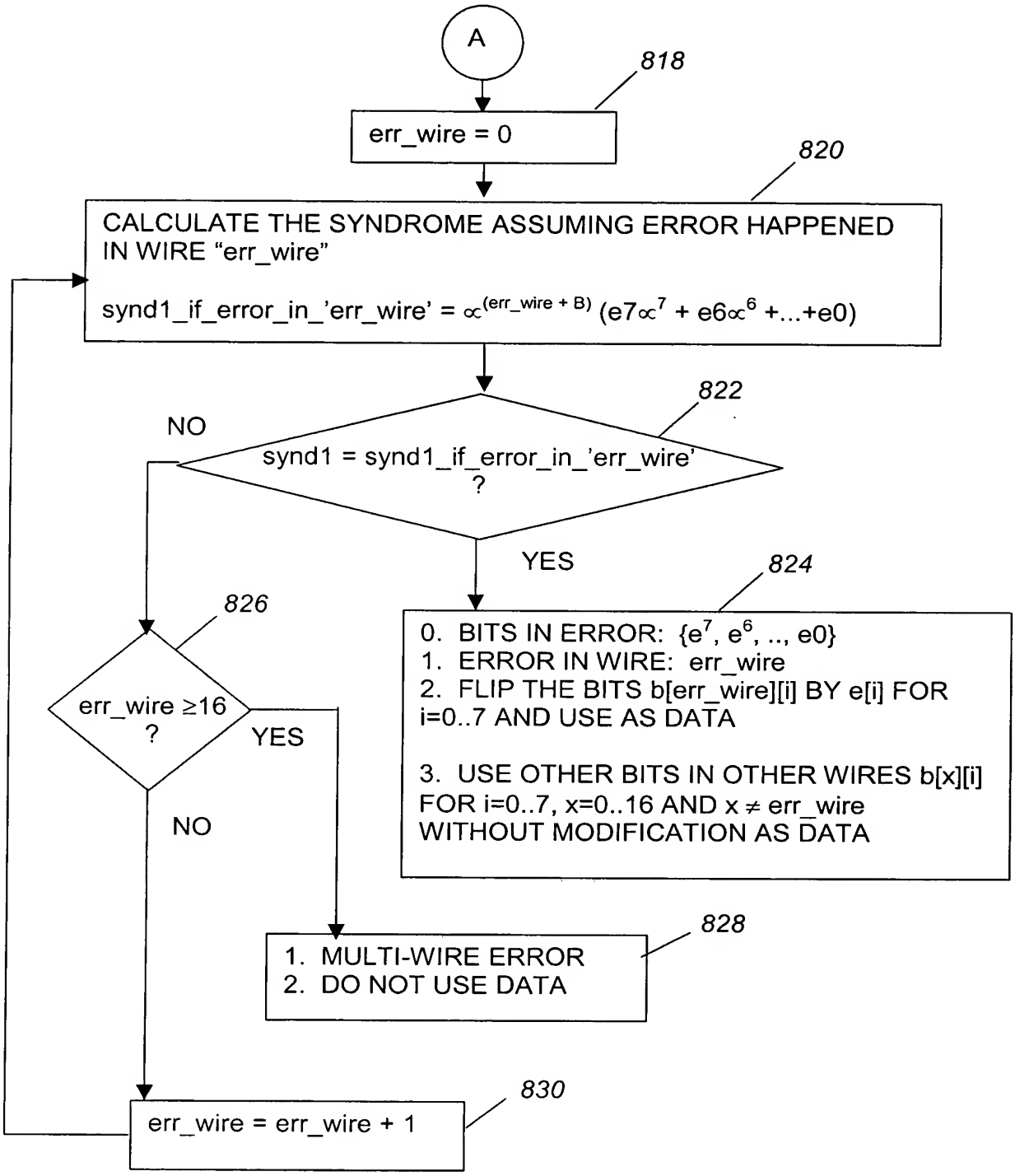
A
818
err_wire = 0
820
CALCULATE THE SYNDROME ASSUMING ERROR HAPPENED IN WIRE "err_wire"
synd1_if_error_in_'err_wire' = ∝^(err_wire + B) (e7∝^7 + e6∝^6 +...+e0)
822
NO
synd1 = synd1_if_error_in_'err_wire' ?
YES
824
826
0. BITS IN ERROR: {e^7, e^6, .., e0}
1. ERROR IN WIRE: err_wire
2. FLIP THE BITS b[err_wire][i] BY e[i] FOR i=0..7 AND USE AS DATA
3. USE OTHER BITS IN OTHER WIRES b[x][i] FOR i=0..7, x=0..16 AND x ≠ err_wire WITHOUT MODIFICATION AS DATA
err_wire ≥16 ?
YES
NO
828
1. MULTI-WIRE ERROR
2. DO NOT USE DATA
830
err_wire = err_wire + 1

*FIG. 8B*

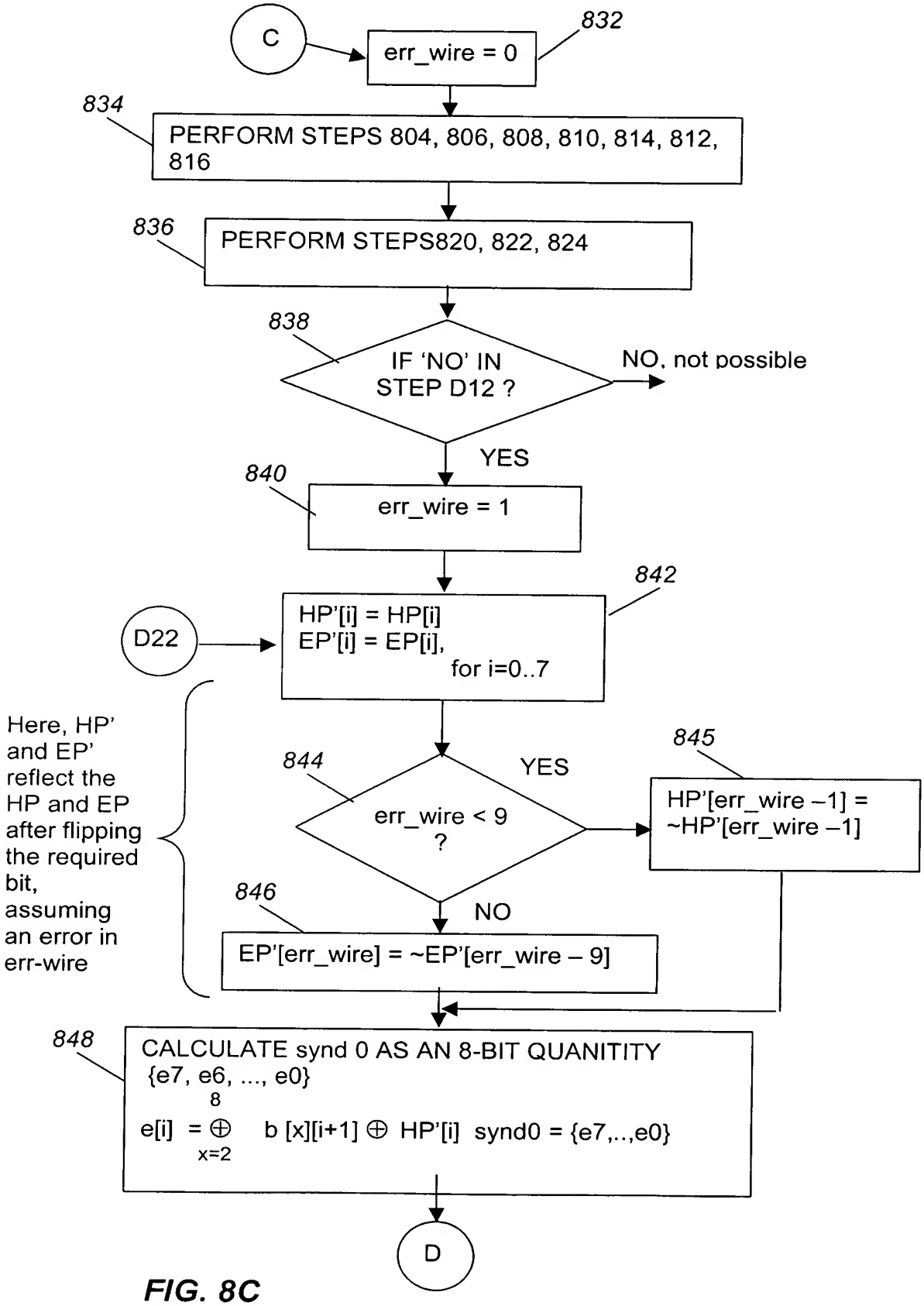
C
832
err_wire = 0
834
PERFORM STEPS 804, 806, 808, 810, 814, 812, 816
836
PERFORM STEPS820, 822, 824
838
IF 'NO' IN STEP D12 ?
NO, not possible
YES
840
err_wire = 1
842
D22
HP'[i] = HP[i]
EP'[i] = EP[i],
for i=0..7
Here, HP' and EP' reflect the HP and EP after flipping the required bit, assuming an error in err-wire
844
err_wire < 9 ?
YES
845
HP'[err_wire –1] = ~HP'[err_wire –1]
846
NO
EP'[err_wire] = ~EP'[err_wire – 9]
848
CALCULATE synd 0 AS AN 8-BIT QUANITITY
{e7, e6, ..., e0}
e[i] = ⊕ (x=2 to 8) b [x][i+1] ⊕ HP'[i] synd0 = {e7,..,e0}
D

*FIG. 8C*

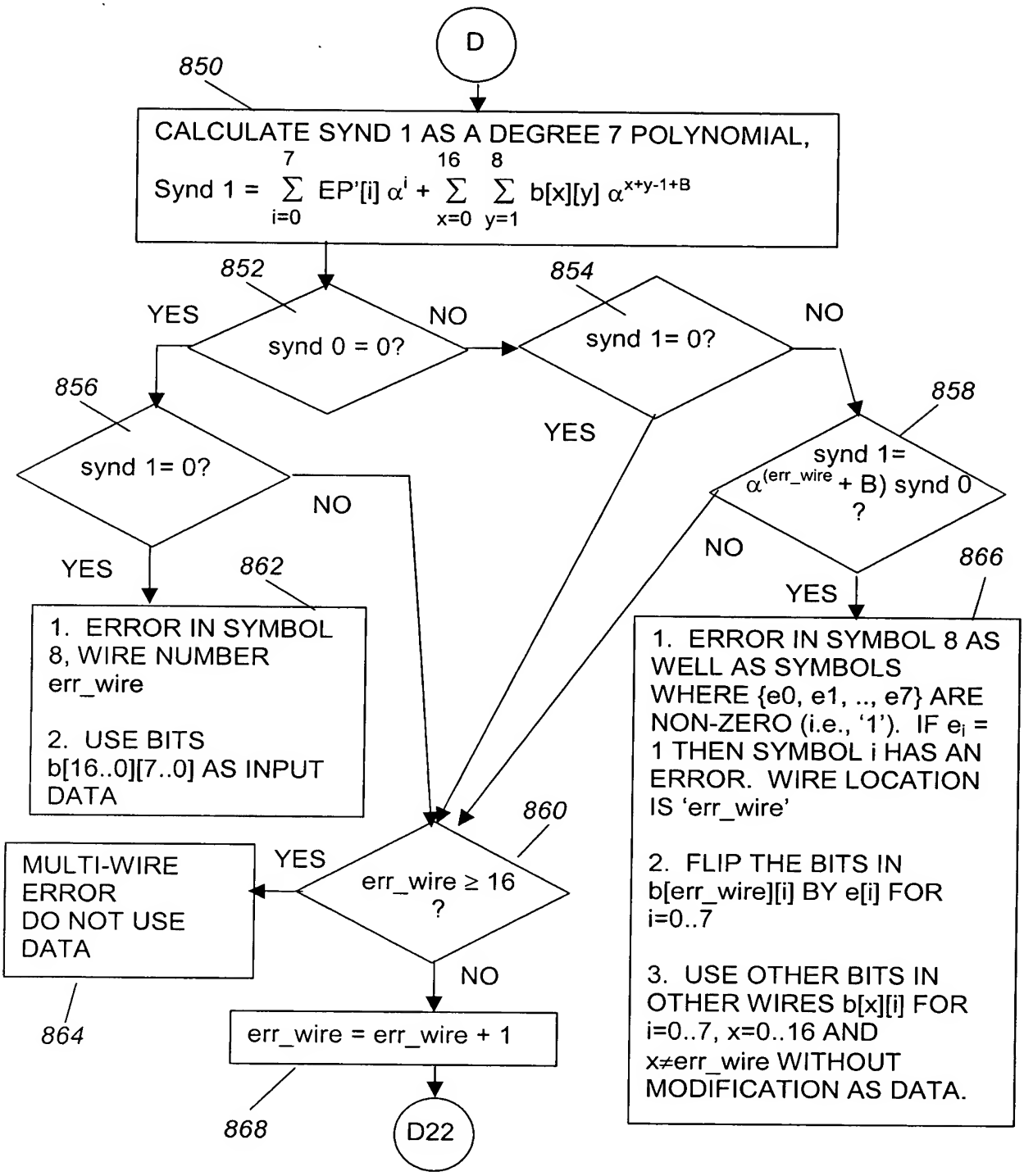
D
850
CALCULATE SYND 1 AS A DEGREE 7 POLYNOMIAL,
Synd 1 = $\sum_{i=0}^{7} EP'[i]\,\alpha^{i} + \sum_{x=0}^{16}\sum_{y=1}^{8} b[x][y]\,\alpha^{x+y-1+B}$
852
synd 0 = 0?
YES
NO
854
synd 1= 0?
NO
YES
856
synd 1= 0?
NO
YES
858
synd 1= $\alpha^{(err\_wire + B)}$ synd 0 ?
NO
YES
862
1. ERROR IN SYMBOL 8, WIRE NUMBER err_wire
2. USE BITS b[16..0][7..0] AS INPUT DATA
866
1. ERROR IN SYMBOL 8 AS WELL AS SYMBOLS WHERE {e0, e1, .., e7} ARE NON-ZERO (i.e., '1'). IF $e_i$ = 1 THEN SYMBOL i HAS AN ERROR. WIRE LOCATION IS 'err_wire'
2. FLIP THE BITS IN b[err_wire][i] BY e[i] FOR i=0..7
3. USE OTHER BITS IN OTHER WIRES b[x][i] FOR i=0..7, x=0..16 AND x≠err_wire WITHOUT MODIFICATION AS DATA.
860
err_wire ≥ 16 ?
YES
MULTI-WIRE ERROR DO NOT USE DATA
864
NO
err_wire = err_wire + 1
868
D22

*FIG. 8D*